Literature Review

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USE OF THE RAPID MOLECULAR TEST FOR TUBERCULOSIS AMONG PEOPLE DEPRIVED OF LIBERTY: A SCOPING REVIEW

Elisangela Franciscon Naves[1]
Rubia Laine de Paula Andrade[2]
Mariana Gaspar Botelho Funari de Faria[1]
Gabriela Tavares Magnabosco[3]
Rafaele Oliveira Bonfim[1]
Melisane Regina Lima Ferreira[1]
Valdes Roberto Bollela[4]
Aline Aparecida Monroe[1]

[1]Universidade de São Paulo, Escola de Enfermagem de Ribeirão Preto, Programa de Pós-Graduação Enfermagem em Saúde Pública. Ribeirão Preto, SP, Brasil.
[2]Universidade de São Paulo, Escola de Enfermagem de Ribeirão Preto, Departamento de Enfermagem Materno-Infantil e Saúde Pública. Ribeirão Preto, SP, Brasil.
[3]Universidade Estadual de Maringá, Departamento de Enfermagem, Programa de Pós-Graduação em Enfermagem. Maringá, PR, Brasil.
[4]Universidade de São Paulo, Faculdade de Medicina de Ribeirão Preto, Departamento de Clínica Médica e Divisão de Moléstias Infecciosas. Ribeirão Preto, SP, Brasil.

ABSTRACT

Objective: to map the repercussions of using the rapid molecular test for diagnosing tuberculosis among people deprived of liberty in the scientific literature.
Method: this is a scoping review following the recommendations of the Joanna Briggs Institute and PRISMA for Scoping Reviews. The search was conducted using controlled and free vocabulary in the following databases: EMBASE, Scopus, MEDLINE, Cinahl, Academic Search Premier, LILACS and Web of Science, in the Brazilian Digital Library of Theses and Dissertations and Google Scholar. The materials which answered the review question were selected by two independent reviewers based on reading the titles, abstracts and publications. All types of studies and publications were included. The extracted data was subjected to narrative synthesis and presented graphically.
Results: a total of 13 among the 461 publications found were included in the review. The studies pointed out the following repercussions of using the rapid molecular test in the prison population: increase in the diagnosis of cases compared to sputum smear microscopy; reduction in diagnosis time, initiating treatment and isolation; identification of strains resistant to antibiotic therapy; reducing the prevalence and occurrence of tuberculosis; high agreement of test results with culture results; lower cost of the test when carried out in groups of samples or when screening is carried out by radiography.
Conclusion: the literature indicated that the rapid molecular test is relevant for combating tuberculosis in prison units, so its use should be considered by authorities and managers as a strategic tool for controlling the disease.

DESCRIPTORS: Tuberculosis. Diagnosis. Molecular diagnostic techniques. Rapid diagnostic tests. Prisons. Prisoners.

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UTILIZAÇÃO DO TESTE RÁPIDO MOLECULAR PARA TUBERCULOSE ENTRE PESSOAS PRIVADAS DE LIBERDADE: REVISÃO DE ESCOPO

RESUMO

Objetivo: mapear as repercussões da utilização do teste rápido molecular para o diagnóstico de tuberculose entre as pessoas privadas de liberdade junto à literatura científica.
Método: revisão de escopo seguiram-se as recomendações do Joanna Briggs Institute e do PRISMA *for Scoping Reviews.* A busca foi realizada com vocabulários controlados e livres nas bases de dados: *EMBASE, Scopus, MEDLINE, Cinahl, Academic Search Premier, LILACS e Web of Science*, na Biblioteca Digital Brasileira de Teses e Dissertações e no *Google Scholar*. Foram selecionados por dois revisores independentes, os materiais que respondiam à pergunta da revisão, a partir da leitura dos títulos, resumos e publicações. Foram incluídos todos os tipos de estudo e publicações. Os dados extraídos foram submetidos à síntese narrativa e apresentados graficamente.
Resultados: entre as 461 publicações encontradas, 13 foram incluídas na revisão. Os estudos apontaram as seguintes repercussões da utilização do teste rápido molecular na população prisional: aumento no diagnóstico de casos comparado à baciloscopia; redução no tempo de diagnóstico, início do tratamento e isolamento; identificação de cepas resistentes à antibioticoterapia; redução da prevalência e ocorrência da tuberculose; alta concordância dos resultados do teste com os da cultura; menor custo do teste quando realizado em grupos de amostras ou quando o rastreamento é realizado por radiografia.
Conclusão: a literatura apontou que o teste rápido molecular é relevante para o enfrentamento da tuberculose nas unidades prisionais, de modo que a sua utilização deve ser considerada pelas autoridades e gestores como uma ferramenta estratégica para o controle da doença.

DESCRITORES: Tuberculose. Diagnóstico. Técnicas de diagnóstico molecular. Testes de diagnóstico rápido. Prisões. Prisioneiros.

USO DE LA PRUEBA MOLECULAR RÁPIDA DE TUBERCULOSIS EN PERSONAS PRIVADAS DE LIBERTAD: REVISIÓN DE ALCANCE

RESUMEN

Objetivo: mapear las repercusiones del uso de la prueba molecular rápida para el diagnóstico de tuberculosis en personas privadas de libertad en la literatura científica.
Método: scoping review, siguiendo las recomendaciones del Joanna Briggs Institute y PRISMA for Scoping Reviews. La búsqueda se realizó utilizando vocabularios controlados y libres en las siguientes bases de datos: EMBASE, Scopus, MEDLINE, Cinahl, Academic Search Premier, LILACS y Web of Science, en la Biblioteca Digital Brasileña de Tesis y Disertaciones y en Google Scholar. Los materiales que respondieron a la pregunta de revisión fueron seleccionados por dos revisores independientes, basándose en la lectura de títulos, resúmenes y publicaciones. Se incluyeron todo tipo de estudios y publicaciones. Los datos extraídos fueron sometidos a síntesis narrativa y presentados gráficamente.
Resultados: entre las 461 publicaciones encontradas, 13 fueron incluidas en la revisión. Los estudios señalaron las siguientes repercusiones del uso de la prueba molecular rápida en la población penitenciaria: aumento del diagnóstico de casos en comparación con la baciloscopia de esputo; reducción del tiempo de diagnóstico, inicio de tratamiento y aislamiento; identificación de cepas resistentes a la terapia con antibióticos; reducir la prevalencia y aparición de la tuberculosis; alta concordancia de los resultados de las pruebas con los resultados del cultivo; menor coste de la prueba cuando se realiza en grupos de muestras o cuando el cribado se realiza mediante radiografía.
Conclusión: la literatura indicó que la prueba molecular rápida es relevante para el combate a la tuberculosis en las unidades penitenciarias, por lo que su uso debe ser considerado por autoridades y gestores como una herramienta estratégica para el control de la enfermedad.

DESCRIPTORES: Tuberculosis. Diagnóstico. Técnicas de diagnóstico molecular. Pruebas de diagnóstico rápido. Prisiones. Prisioneros.

INTRODUCTION

Tuberculosis (TB) remains a global public health problem. It is estimated that 10.6 million people became ill with TB worldwide in 2022, ahead of estimates of 10.3 million in 2021 and 10.0 million in 2020[1]. Since the transmission of the TB bacillus occurs from person to person, through the air, it is unquestionable that prisons are places of high risk for its transmissibility due to the high incarceration rate, inadequate infrastructure and ventilation, poor hygiene, limited exposure to sunlight and difficulty accessing health services[2,3,4].

This scenario is legitimized from an epidemiological point of view, since the incidence of TB among People Deprived of Liberty (PDL) is higher when compared to the general population in several countries, as occurs in prisons in the European Region whose notification rate of new cases of the disease reaches 628 cases/100 thousand inhabitants[5]. PDL in the Americas region represents 44.1% of all TB cases in El Salvador and 16.1% in Venezuela. There were 34.9 cases of TB per 100 thousand inhabitants in Brazil in 2021, and this number rose to 36.3 cases in 2022; however, it is still below the records observed before the pandemic[6–7].

Brazil has the third largest PDL in the world, behind only the United States of America and China. According to data from the latest INFOPEN (National Survey of Penitentiary Information, 2023), Brazil currently has a PDL of around 839 thousand, but the available vacancies total only 481 thousand[8–9].

The literature points out that strains of the bacteria circulating in the prison system are found in samples from people diagnosed with TB in the community, showing that the transmission of bacilli goes beyond the geographical limits of prisons[10]. That said, and considering the international goals proposed by the World Health Organization (WHO) to eliminate TB as a public health problem by 2035 (End TB Strategy[11]), the need to control the occurrence and prevalence of the disease in the prison system is undeniable.

Therefore, it is necessary to advance in technologies and strategies to diagnose TB early in PDL, with the prerogative of reducing sources of infection and promoting breaks in the disease transmission chain[12]. In this sense, it is worth mentioning that in 2010, the WHO recommended the use of the Rapid Molecular Test for TB (RMT-TB) in the Global Stop TB Plan 2011-2015[13]. This test detects the DNA of Mycobacterium tuberculosis by amplifying nucleic acids through the DNA Polymerase Chain Reaction (PCR) technique in a sample of sputum or other material within a period of up to two hours, as well as identifying strains resistant to rifampicin, one of the main first-line antibiotics used in the treatment of TB[14–15].

From this perspective, this study aims to map the repercussions of using RMT-TB among PDL together with the scientific literature. The innovative potential of this study is evident since no protocol or scoping review records on this topic were identified in a preliminary search on MEDLINE and the Open Science Framework Registries (OSFREGISTRIES) platform.

METHOD

This is a scoping review which was constructed according to the methodology developed by the Joanna Briggs Institute Reviewer's Manual for Scoping Reviews[16] and followed the recommendations of the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews Checklist (PRISMA-ScR)[17]. This review was registered on the Open Science Framework Registries platform (OSFREGISTRIES) (doi.org/10.17605/OSF.IO/3WR56).

The preparation of this review included the following steps: identification of the guiding research question and relevant publications; selection of publications; data extraction; analysis and synthesis of results[18].

Descriptors to survey the publications were identified which derive from the question: "What are the repercussions of using the RMT-TB for diagnosing TB among PDL in prison units?", using the Population, Concept and Context (PCC) strategy, in which: Population (P) corresponds to the PDL; the Concept (C) to the repercussions of using the RMT-TB; and the Context (C), the prison units.

All types of studies and publications were included in this review, meaning those which used any type of approach and methodological design. Studies which did not evaluate the repercussion of using the RMT-TB (Xpert MTB/RIF or Ultra) were excluded, as well as studies which did not consider PDL among the studied population.

The searches were conducted in January 2023 in the following databases: Scopus, Web of Science, Pubmed/MEDLINE, Latin American and Caribbean Literature in Health Sciences (LILACS), Academic Search Premier (ASP), Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Embase. In addition, publications were searched in the Brazilian Digital Library of Theses and Dissertations (BDTD) and Google Scholar.

To this end, a survey was initially conducted of the free and controlled vocabulary used in writing publications on the topic in question, which served to develop publication search strategies (Chart 1) and were suitable for each database using the Boolean operators AND and OR. The searches were limited to materials published from 2010 onwards, the year in which the RMT-TB was recommended for diagnosing TB[13].

After searching the literature, all publications identified in the databases (except BDTD and Google Scholar) were exported to Rayyan QCRI of the Qatar Computing Research Institute[19]. After export, duplicate publications were excluded, with the remaining ones being subjected to a selection process by two independent reviewers who read the titles and abstracts. The publications identified in BDTD and Google Scholar (in this case, up to the first 10 pages of each search or less) were exported to a Word file, which made it possible to select the publications by reading the titles by two independent reviewers. Disagreements and doubts in the selection of publications were resolved by an additional reviewer, and subsequently by reading the materials in full.

The study selection and inclusion process was presented in a flowchart, as proposed by the Preferred Reporting Items for Systematic reviews and Meta-Analyses 2020 Statement (PRISMA)[20].

Data extraction was performed using a structured form that contained the following variables: authors, name of the journal, year of publication, country of study, type of publication, study design, objective, study population/sample and main results. These results were subjected to a narrative synthesis, which were presented graphically using hexagons differentiated by colors and sizes, as recommended by some authors[21], to enable visualization of the most discussed repercussions of using the RMT-TB in PDL. Thus, each hexagon indicated a result and the number of studies in which each one was present.

Chart 1 – Strategies used to search for publications to conduct the scoping review on the repercussions of using the rapid molecular test for diagnosing tuberculosis among the population deprived of liberty according to the sources of information. Ribeirão Preto (SP), Brazil, 2023.

Information sources	Search strategies
Scopus	*TITLE-ABS-KEY (tuberculosis OR tb) AND TITLE-ABS-KEY (prison OR prisons OR "penal institution" OR "penal institutions" OR "social adaptation centers" OR "penal centers" OR jail OR jails OR "people deprived of liberty" OR "person deprived of liberty" OR "persons deprived of liberty" OR "population deprived of liberty" OR inmate OR inmates OR prisoner OR prisoners OR detainee OR detainees OR arrested) AND TITLE-ABS-KEY ("rapid molecular test" OR "rapid molecular diagnostic test" OR "rapid molecular diagnostic testing" OR xpert OR "rapid molecular assay" OR "rapid molecular assays" OR "rapid molecular diagnostic assay" OR "rapid molecular diagnostic assays" OR "rapid diagnostic test" OR "rapid diagnostic testing" OR "rapid diagnostic assay" OR "rapid diagnostic assays" OR "rapid molecular detection test" OR "rapid molecular detection testing" OR "rapid molecular detection assay" OR "rapid molecular detection assays" OR "rapid molecular detection method" OR "rapid molecular detection methods" OR "sputum molecular testing assay" OR "sputum molecular testing assays" OR "rapid molecular screening" OR "rapid molecular detection of tuberculosis" OR "rapid molecular diagnostic for tuberculosis" OR "rapid molecular diagnosis of tuberculosis" OR "rapid molecular detection of mycobacterium tuberculosis" OR "rapid molecular diagnostic for mycobacterium tuberculosis" OR "rapid molecular diagnosis of mycobacterium tuberculosis")*
Web of Science	*((TS=(tuberculosis OR tb)) AND TS=(prison OR prisons OR "penal institution" OR "penal institutions" OR "social adaptation centers" OR "penal centers" OR jail OR jails OR "people deprived of liberty" OR "person deprived of liberty" OR "persons deprived of liberty" OR "population deprived of liberty" OR inmate OR inmates OR prisoner OR prisoners OR detainee OR detainees OR arrested)) AND TS=("rapid molecular test" OR "rapid molecular diagnostic test" OR "rapid molecular diagnostic testing" OR xpert OR "rapid molecular assay" OR "rapid molecular assays" OR "rapid molecular diagnostic assay" OR "rapid molecular diagnostic assays" OR "rapid diagnostic test" OR "rapid diagnostic testing" OR "rapid diagnostic assay" OR "rapid diagnostic assays" OR "rapid molecular detection test" OR "rapid molecular detection testing" OR "rapid molecular detection assay" OR "rapid molecular detection assays" OR "rapid molecular detection method" OR "rapid molecular detection methods" OR "sputum molecular testing assay" OR "sputum molecular testing assays" OR "rapid molecular screening" OR "rapid molecular detection of tuberculosis" OR "rapid molecular diagnostic for tuberculosis" OR "rapid molecular diagnosis of tuberculosis" OR "rapid molecular detection of mycobacterium tuberculosis" OR "rapid molecular diagnostic for mycobacterium tuberculosis" OR "rapid molecular diagnosis of mycobacterium tuberculosis")*
Pubmed / MEDLINE	*((tuberculosis OR tb) AND (prison OR prisons OR "penal institution" OR "penal institutions" OR "social adaptation centers" OR "penal centers" OR jail OR jails OR "people deprived of liberty" OR "person deprived of liberty" OR "persons deprived of liberty" OR "population deprived of liberty" OR inmate OR inmates OR prisoner OR prisoners OR detainee OR detainees OR arrested)) AND ("rapid molecular test" OR "rapid molecular diagnostic test" OR "rapid molecular diagnostic testing" OR xpert OR "rapid molecular assay" OR "rapid molecular assays" OR "rapid molecular diagnostic assay" OR "rapid molecular diagnostic assays" OR "rapid diagnostic test" OR "rapid diagnostic testing" OR "rapid diagnostic assay" OR "rapid diagnostic assays" OR "rapid molecular detection test" OR "rapid molecular detection testing" OR "rapid molecular detection assay" OR "rapid molecular detection assays" OR "rapid molecular detection method" OR "rapid molecular detection methods" OR "sputum molecular testing assay" OR "sputum molecular testing assays" OR "rapid molecular screening" OR "rapid molecular detection of tuberculosis" OR "rapid molecular diagnostic for tuberculosis" OR "rapid molecular diagnosis of tuberculosis" OR "rapid molecular detection of mycobacterium tuberculosis" OR "rapid molecular diagnostic for mycobacterium tuberculosis" OR "rapid molecular diagnosis of mycobacterium tuberculosis")*

Chart 1 – Cont.

Information sources	Search strategies
LILACS	*(Tuberculose OR tuberculosis OR tb) AND (prisão OR prisões OR "instituição penal" OR "instituições penais" OR "centro de readaptação social" OR "centros de readaptação social" OR "centros penais" OR cárcere OR cárceres OR penitenciária OR penitenciárias OR presídio OR presídios OR "unidade prisional" OR "unidades prisionais" OR "pessoa privada de liberdade" OR "pessoas privadas de liberdade" OR "população privada de liberdade" OR detento OR detentos OR encarcerado OR encarcerada OR encarcerados OR encarceradas OR prisioneiro OR prisioneiros OR prisioneira OR prisioneiras OR preso OR presos OR sentenciado OR sentenciados OR apenado OR apenados OR prison OR prisons OR "penal institution" OR "penal institutions" OR "social adaptation centers" OR "penal centers" OR jail OR jails OR "people deprived of liberty" OR "person deprived of liberty" OR "persons deprived of liberty" OR "population deprived of liberty" OR inmate OR inmates OR prisoner OR prisoners OR detainee OR detainees OR arrested OR prisión OR prisiones OR "institución penal" OR "institucións penales" OR "centro de readaptación social" OR "centros de readaptación social" OR "centro penal" OR "centros penales" OR cárcel OR cárceles OR penitenciaría OR penitenciarías OR "persona privada de libertad" OR "personas privadas de libertad" OR "población privada de libertad" OR detenido OR detenidos OR encarcelado OR encarcelados OR encarcelada OR encarceladas OR prisionero OR prisioneros OR prisionera OR prisioneras OR preso OR presos OR arrestado OR sentenciado OR sentenciados OR condenado OR condenados) AND ("teste rápido molecular" OR "teste molecular rápido" OR "rapid molecular test" OR "rapid molecular diagnostic test" OR "rapid molecular diagnostic testing" OR xpert OR genexpert OR "rapid molecular assay" OR "rapid molecular assays" OR "rapid molecular diagnostic assay" OR "rapid molecular diagnostic assays" OR "rapid diagnostic test" OR "rapid diagnostic testing" OR "rapid diagnostic assay" OR "rapid diagnostic assays" OR "rapid molecular detection test" OR "rapid molecular detection testing" OR "rapid molecular detection assay" OR "rapid molecular detection assays" OR "rapid molecular detection method" OR "rapid molecular detection methods" OR "sputum molecular testing assay" OR "sputum molecular testing assays" OR "rapid molecular screening" OR "rapid molecular detection of tuberculosis" OR "rapid molecular diagnostic for tuberculosis" OR "rapid molecular diagnosis of tuberculosis" OR "rapid molecular detection of mycobacterium tuberculosis" OR "rapid molecular diagnostic for mycobacterium tuberculosis" OR "rapid molecular diagnosis of mycobacterium tuberculosis" OR "prueba rápida molecular" OR "pruebas rápidas moleculares" OR "prueba molecular rápida" OR "pruebas moleculares rápidas" OR "diagnóstico molecular rápido")*
Academic Search Premier/ CINAHL	*(tuberculosis OR tb) AND (prison OR prisons OR "penal institution" OR "penal institutions" OR "social adaptation centers" OR "penal centers" OR jail OR jails OR "people deprived of liberty" OR "person deprived of liberty" OR "persons deprived of liberty" OR "population deprived of liberty" OR inmate OR inmates OR prisoner OR prisoners OR detainee OR detainees OR arrested) AND ("rapid molecular test" OR "rapid molecular diagnostic test" OR "rapid molecular diagnostic testing" OR xpert OR "rapid molecular assay" OR "rapid molecular assays" OR "rapid molecular diagnostic assay" OR "rapid molecular diagnostic assays" OR "rapid diagnostic test" OR "rapid diagnostic testing" OR "rapid diagnostic assay" OR "rapid diagnostic assays" OR "rapid molecular detection test" OR "rapid molecular detection testing" OR "rapid molecular detection assay" OR "rapid molecular detection assays" OR "rapid molecular detection method" OR "rapid molecular detection methods" OR "sputum molecular testing assay" OR "sputum molecular testing assays" OR "rapid molecular screening" OR "rapid molecular detection of tuberculosis" OR "rapid molecular diagnostic for tuberculosis" OR "rapid molecular diagnosis of tuberculosis" OR "rapid molecular detection of mycobacterium tuberculosis" OR "rapid molecular diagnostic for mycobacterium tuberculosis" OR "rapid molecular diagnosis of mycobacterium tuberculosis")*

Chart 1 – Cont.

Information sources	Search strategies
Embase	*('tuberculosis'/exp OR tuberculosis OR 'tb'/exp OR tb) AND ('prison'/exp OR prison OR 'prisons'/exp OR prisons OR 'penal institution'/exp OR 'penal institution' OR 'penal institutions' OR 'social adaptation centers' OR 'penal centers' OR 'jail'/exp OR jail OR 'jails'/exp OR jails OR 'people deprived of liberty' OR 'person deprived of liberty' OR 'persons deprived of liberty' OR 'population deprived of liberty' OR 'inmate'/exp OR inmate OR 'inmates'/exp OR inmates OR 'prisoner'/exp OR prisoner OR 'prisoners'/exp OR prisoners OR detainee OR detainees OR arrested(AND ('rapid molecular test' OR 'rapid molecular diagnostic test' OR 'rapid molecular diagnostic testing' OR 'xpert'/exp OR xpert OR 'rapid molecular assay' OR 'rapid molecular assays' OR 'rapid molecular diagnostic assay' OR 'rapid molecular diagnostic assays' OR 'rapid diagnostic test'/exp OR 'rapid diagnostic test' OR 'rapid diagnostic testing' OR 'rapid diagnostic assay' OR 'rapid diagnostic assays' OR 'rapid molecular detection test' OR 'rapid molecular detection testing' OR 'rapid molecular detection assay' OR 'rapid molecular detection assays' OR 'rapid molecular detection method' OR 'rapid molecular detection methods' OR 'sputum molecular testing assay' OR 'sputum molecular testing assays' OR 'rapid molecular screening' OR 'rapid molecular detection of tuberculosis' OR 'rapid molecular diagnostic for tuberculosis' OR 'rapid molecular diagnosis of tuberculosis' OR 'rapid molecular detection of mycobacterium tuberculosis' OR 'rapid molecular diagnostic for mycobacterium tuberculosis' OR 'rapid molecular diagnosis of mycobacterium tuberculosis')*
Biblioteca Digital Brasileira de Teses e Dissertações	"*(Todos os campos: Tuberculose OR tuberculosis OR tb E Todos os campos: prisão OR prisões OR "instituição penal" OR "instituições penais" OR "centro de readaptação social" OR "centros de readaptação social" OR "centros penais" OR cárcere OR cárceres OR penitenciária OR penitenciárias OR presídio OR presídios OR "unidade prisional" OR "unidades prisionais" OR "pessoa privada de liberdade" OR "pessoas privadas de liberdade" OR "população privada de liberdade" OR detento OR detentos OR encarcerado OR encarcerada OR encarcerados OR encarceradas OR prisioneiro OR prisioneiros OR prisioneira OR prisioneiras OR preso OR presos OR sentenciado OR sentenciados OR apenado OR apenados OR prison OR prisons OR "penal institution" OR "penal institutions" OR "social adaptation centers" OR "penal centers" OR jail OR jails OR "people deprived of liberty" OR "person deprived of liberty" OR "persons deprived of liberty" OR "population deprived of liberty" OR inmate OR inmates OR prisoner OR prisoners OR detainee OR detainees OR arrested OR prisión OR prisiones OR "institución penal" OR "instituciónes penales" OR "centro de readaptación social" OR "centros de readaptación social" OR "centro penal" OR "centros penales" OR cárcel OR cárceles OR penitenciaría OR penitenciarías OR "persona privada de libertad" OR "personas privadas de libertad" OR "población privada de libertad" OR detenido OR detenidos OR encarcelado OR encarcelados OR encarcelada OR encarceladas OR prisionero OR prisioneros OR prisionera OR prisioneras OR preso OR presos OR arrestado OR sentenciado OR sentenciados OR condenado OR condenados E Todos os campos:"teste rápido molecular" OR "teste molecular rápido" OR "rapid molecular test" OR "rapid molecular diagnostic test" OR "rapid molecular diagnostic testing" OR xpert OR genexpert OR "rapid molecular assay" OR "rapid molecular assays" OR "rapid molecular diagnostic assay" OR "rapid molecular diagnostic assays" OR "rapid diagnostic test" OR "rapid diagnostic testing" OR "rapid diagnostic assay" OR "rapid diagnostic assays" OR "rapid molecular detection test" OR "rapid molecular detection testing" OR "rapid molecular detection assay" OR "rapid molecular detection assays" OR "rapid molecular detection method" OR "rapid molecular detection methods" OR "sputum molecular testing assay" OR "sputum molecular testing assays" OR "rapid molecular screening" OR "rapid molecular detection of tuberculosis" OR "rapid molecular diagnostic for tuberculosis" OR "rapid molecular diagnosis of tuberculosis" OR "rapid molecular detection of mycobacterium tuberculosis" OR "rapid molecular diagnostic for mycobacterium tuberculosis" OR "rapid molecular diagnosis of mycobacterium tuberculosis" OR "prueba rápida molecular" OR "pruebas rápidas moleculares" OR "prueba molecular rápida" OR "pruebas moleculares rápidas" OR "diagnóstico molecular rápido")*"
Google Scholar (six searches were carried out)	*tuberculose prisões "teste rápido molecular"* *tuberculose prisioneiros "teste rápido molecular"* *tuberculosis prisons "rapid molecular test"* *tuberculosis prisoners "rapid molecular test"* *tuberculosis prisiones "prueba rapida molecular"* *tuberculosis prisioneros "rapid molecular test"*

RESULTS

A total of 232 publications were identified in the databases and another 229 were identified in other sources (n=461). Next, 230 duplicate documents and 197 were excluded during the title and abstract reading process. Thus, 34 publications were considered eligible for reading in full, and of these, 20 were excluded for not responding to the study proposal. Consequently, a total of 13 studies were included in this review (Figure 1).

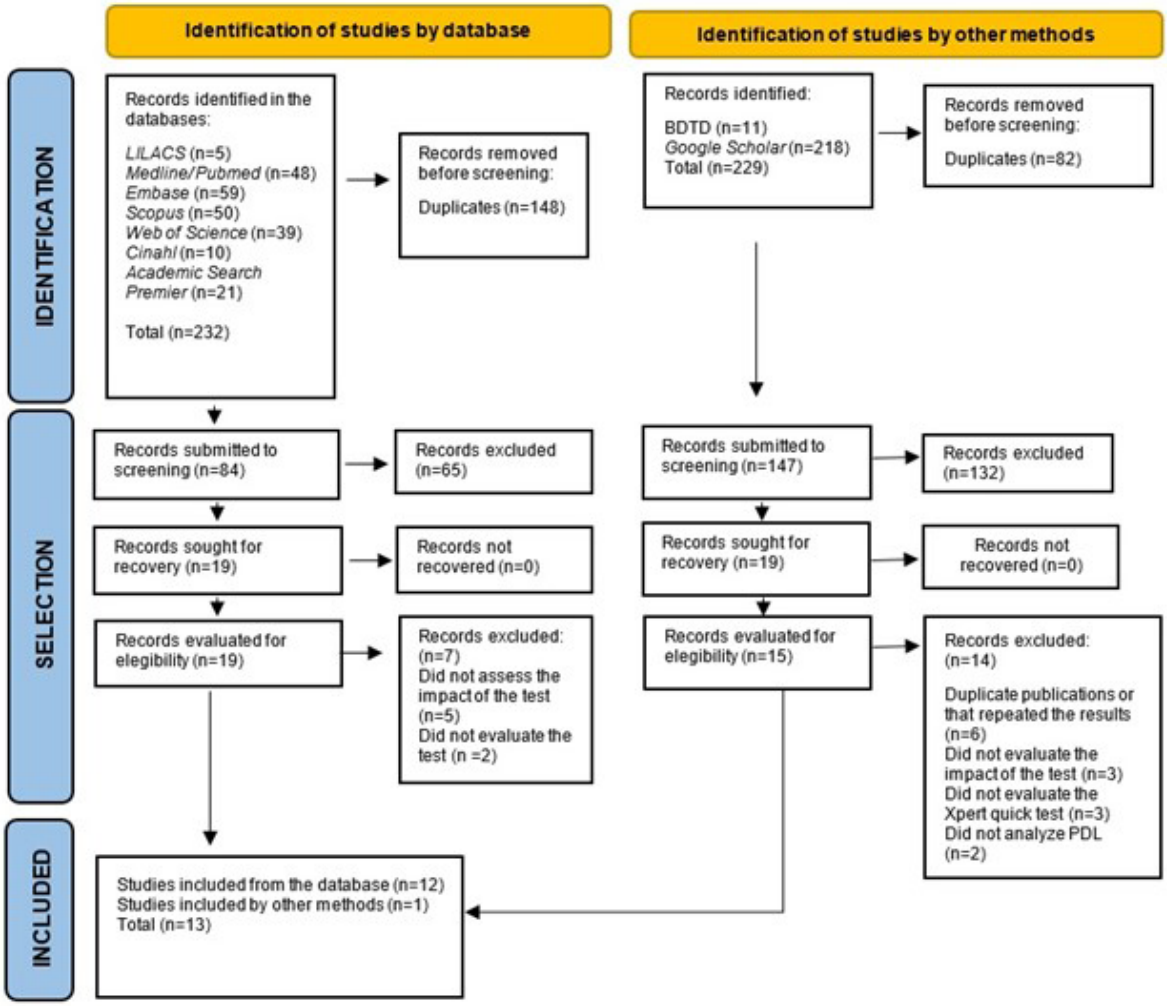

Figure 1 – Flowchart of identification and selection of publications included in the scoping review on the impact of the use of rapid molecular testing for diagnosing tuberculosis among people deprived of liberty in prison units. Ribeirão Preto (SP), Brazil, 2023.
Legend: BDTD – *Biblioteca Digital Brasileira de Teses e Dissertações*; PDL – People Deprived of Liberty.
Source: Adapted from[20].

For the publication years, one study was published on the subject in the year 2012[22], one in 2013[23], two in 2017[24–25], three in 2018[26–28], one in 2020[29], three in 2021[30–32], and two in 2022[33–34]. Six studies were conducted in Latin America (Brazil)[26,28,31–34], two in Europe (Azerbaijan and France)[24,30], three in Asia (Malaysia, Philippines and Thailand)[23,25,29], one in countries of Western Europe and Asia (Russia)[22], and one in Africa (Ethiopia)[27] (Chart 2).

Of the 13 studies selected, 11 were scientific articles[22–23,25–30,32–34], one was a summary that was published in annals of events[24], and one was a preprint article[31]. Regarding the type of study, five were cross-sectional[23,26–27,29,31], two prospective[32,34], one on cost-effectiveness[22], one retrospective cohort[28], one descriptive[33], one retrospective review[25], one on diagnostic accuracy[30], and one in which the type of study was not identified[24], as it was not available in full (Chart 2).

Chart 2 – Description of the articles included in the scoping review on the performance of using the rapid molecular test for diagnosis of tuberculosis among people deprived of liberty in prison units, Ribeirão Preto (SP), Brazil, 2023.

Authors, year of publication/ Journal/ Country	Type of publication	Study design	Objective	Study population (n)	Main results
Winetsky et al., 2012[22] / PLOS Medicine / Russia and Western Europe	Article	Cost-effectiveness study	Develop models to simulate simultaneous TB* and MDR-TB† epidemics in prisons in order to assess the relative effectiveness and cost-effectiveness of alternative strategies for TB* screening and diagnosis available to prison health administrators.	It used public data without identification, but did not mention the size of the population studied.	The use of RMT-TB‡ as an annual primary screening tool among the prison population more effectively reduced the prevalence of TB* (from 2.78% to 2.31%) and the prevalence of MDR-TB† (from 0.74% to 0.63%). The addition of RMT-TB‡ to the currently used strategy of annual mass radiography screening was cost-effective over 10 years compared with mass radiography screening alone, but produced only a modest reduction in the prevalence of MDR-TB† (from 0. 74% to 0.69%) and had minimal effect on TB* prevalence (from 2.78% to 2.74%).
Al-Darraji et al., 2013[23] / PLOS ONE / Malaysia	Article	Cross-sectional study	To estimate the diagnostic accuracy of a single RMT-TB‡ assay and assess the correlates of active TB* among PDL§ living with HIV‖ in a Malaysian prison.	125 PDL§ with HIV‖	The sensitivity of RMT-TB‡ for pulmonary cases was 53.3%, while the specificity and positive predictive value was 100%. The negative predictive value of the test was 94%. RMT-TB‡ diagnosed eight of the 15 cases confirmed by sputum culture, while sputum smear microscopy diagnosed only one case.
Gurbanova et al., 2017[24] / European Respiratory Journal / Azerbaijan	Resumo publicado em anais de evento	Not reported	To evaluate the impact of systematic screening with chest radiography and RMT-TB‡ on the incidence of TB* in prisons with a high burden of the disease	2,315 PDL§ with TB*	Systematic screening and screening at the entrance of the PDL§ to the prison unit with RMT-TB‡ enabled greater identification of bacilliferous cases (adjusted odds ratio 1.49 and 2.0, respectively) when compared to mass screening by sputum smear microscopy. The notification rate decreased significantly after the introduction of systematic screening.

Chart 2 – Cont.

Authors, year of publication/ Journal/ Country	Type of publication	Study design	Objective	Study population (n)	Main results
Morishita et al., 2017[25] / PLOS ONE / The Phillippines	Article	Retrospective review	Describe TB* diagnostic yield and treatment outcomes for different target populations. Examine predictors of TB* and the contribution of improved diagnostic tools to overall case detection.	25,103 individuals participated in the study, of which 6,133 were PDL§	2,130 PDL§ were subjected to both tests: RMT-TB‡ and sputum smear microscopy, with 358 (16.8%) positive to RMT-TB‡ and 217 (10.2%) positive to sputum smear microscopy. RMT-TB‡ also diagnosed 29 cases of resistance to rifampicin.
Magalhães et al., 2018[26] / Revista Brasileira de Análises Clínicas / Brazil	Article	Prospective cross-sectional study	To evaluate an easy-to-perform and low-cost procedure to increase the performance of conventional direct smear microscopy in the diagnosis of pulmonary TB* in PDL§.	436 sputum samples	When comparing the performance of the evaluated methods in relation to culture, the sensitivity of conventional direct sputum smear microscopy was 70%, that of processed sputum sputum smear microscopy was 87% and that of RMT-TB‡ was 89%. The specificity of these tests was 99%, 99% and 97%, respectively. The positive predictive value was 98%, 93% and 84%, respectively, while the negative predictive value was 94%, 98% and 98%. The reference test was RMT-TB, the sensitivity of direct sputum smear microscopy was 65%, of processed sputum smear microscopy was 84% and culture of 84%.
Merid et al., 2018[27] / The International Journal of Tuberculosis and Lung Disease / Ethiopia	Article	Cross-sectional study	Determine pulmonary TB* burden using active case finding among PDL§.	2,068 PDL§, of which 372 had a cough and were tested with microscopy and RMT-TB	Carrying out RMT-TB‡ enabled identifying 31 (8%) cases of pulmonary TB*, while microscopy identified eight (2%) cases. RMT-TB‡ also enabled identifying a case of resistance to rifampicin.
Monteiro et al., 2018[28] / Colloq Vitae / Brazil	Article	Retrospective cohort	Analyze the importance of automated culture (“gold standard”), the performance of RMT-TB‡ and the distribution of the TB* quantity in five prison units.	4,509 PDL§	RMT-TB‡ presented a specificity of 99.0%, sensitivity of 72.7% and agreement of 97.0% in results when compared to culture (Reference Test).

Chart 2 – Cont.

Authors, year of publication/ Journal/ Country	Type of publication	Study design	Objective	Study population (n)	Main results
Buangoen; Ingviya, 2020[29] / Journal of the Medical Association of Thailand / Thailand	Article	Cross-sectional study	To estimate the prevalence of pulmonary TB* in four prisons in Songkhla Province and evaluate the factors affecting the results of the RMT-TB‡ trial	10,626 PDL§ initially tested with X-ray, and if image suggestive of pulmonary TB* they were submitted to microscopy or RMT-TB‡	The RMT-TB‡ did not help diagnose TB* in prisons in this study.
Evrevin et al., 2021[30] / Journal of Infection / France	Article	Diagnostic accuracy	Assess the feasibility and interest of implementing RMT-TB‡ in prison hospitals to reduce delays in diagnosis.	76 PDL§ admitted to a custody hospital	The overall sensitivity, specificity, positive and negative predictive values of RMT-TB‡ were respectively: 92.3%, 100%, 100% and 98.7% in raw sputum. The efficiency of RMT-TB‡ was superior to sputum smear microscopy and confirmed by a 97% agreement with culture findings. The delay in microbiological diagnosis was reduced from 18 to 13 days for inmates with negative smear microscopy. RMT-TB‡ results helped accelerate the suspension of prisoner isolation.
Fajer et al., 2021[31] / medRxiv preprint / Brazil	Preprint Article	Retrospective cross-sectional study	Analyze the *SINAN*¶ registry to quantify the use of RMT-TB‡ and chest radiography in PDL§ in Brazil and identify critical gaps in the use of recommended diagnostic methods.	258,014 new TB* cases reported between 2015 and 2018	Diagnosis with RMT-TB‡ varied from 4.7% and 4.9% in Pará and Mato Grosso, to 64.5% and 72.4% in Goiás and Amapá, respectively. Among 26 municipalities in Brazil with at least five thousand individuals and five cases of TB* diagnosed between 2015-2018, seven reported that less than 36.2% (national average) of incarcerated patients were diagnosed with RMT-TB‡.

Chart 2 – Cont.

Authors, year of publication/ Journal/ Country	Type of publication	Study design	Objective	Study population (n)	Main results
Santos et al., 2021[32] / Clinical Infectious Diseases / Brazil	Article	Prospective study	To analyze the yield, efficiency and costs associated with four TB* screening algorithms in PDL§.	5,387 PDL§	Using a single RMT-TB‡ sputum test for all resulted in the detection of 74% of cases at a lower cost ($249 per case detected). Using a single RMT-TB‡ sputum test only for those reporting TB symptoms had a similar cost ($255) but resulted in a lower yield (65%). Two strategies using chest radiography with computer-assisted detection associated with RMT-TB‡ had higher costs ($331 and $384, respectively, per case detected), with the fourth strategy having a slightly higher yield than the first (78% vs 74%).
Freitas et al., 2022[33] / Cogitare Enfermagem / Brasil	Article	Descriptive study	To compare the performance of diagnostic tests and monitoring of TB* between the general population and populations in situations of social vulnerability in the city of Belo Horizonte (MG).	249 PDL§	A reduction in the average time to start treatment in PDL was observed with the introduction of RMT-TB‡ (the average time decreased from 16.57 days to 0.95 days)
Santos et al., 2022[34] / Clinical Infectious Diseases / Brasil	Article	Prospective study	To evaluate the sensitivity and specificity of the pooled sputum test with RMT-TB‡ compared to the individual test; Evaluate how the size of the sputum cluster affects screening efficiency in scenarios with different TB prevalence; Estimate costs for screening using pooled sputum testing with RMT-TB‡.	1,280 sputum samples from PDL§	The study grouped four, eight, 12 and 16 sputum samples. Sample pooling sensitivity and specificity were high (sensitivity: 94%; 95% confidence interval [CI]: 88–98; specificity: 100%, 95%CI:84–100). Sensitivity was higher in clusters where the positive sample had a high mycobacterial load compared to low loads (100% vs 88%). In places with higher TB* prevalence, clusters of four and eight samples were more efficient than larger clusters. Larger pools decreased costs by 87% in low prevalence sites, while smaller sample pools led to greater cost savings in sites with higher TB* prevalence (57%).

Legend: *TB – Tuberculosis; †MDR-TB – Multidrug-resistant Tuberculosis; ‡RMT-TB – Rapid Molecular Test for Tuberculosis; §PDL – People Deprived of Liberty; ‖HIV – Human Immunodeficiency Virus; ¶*SINAN* – Notifiable Diseases Information System.

Through the review, it was possible to summarize the results of studies that deal with the impact of using RMT-TB for the diagnosis of TB among PDL, which are presented in Figure 2.

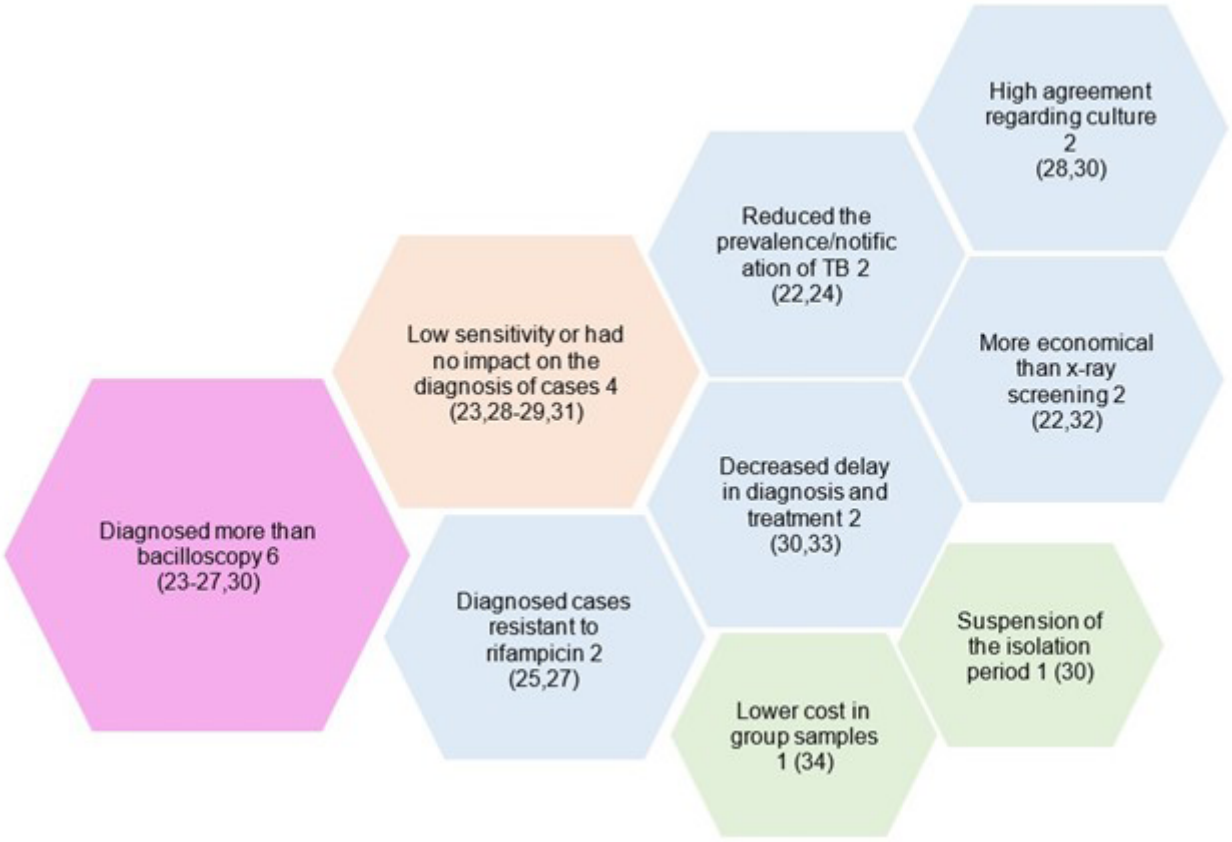

Figure 2 – Map of the results of the scoping review on the impact of using the rapid molecular test for the diagnosis of tuberculosis among people deprived of liberty in prison units, Ribeirão Preto (SP), Brazil, 2023.

DISCUSSION

The relationship between microorganisms and contagious diseases became increasingly evident from the advent of microscopy, and consequently the 20th century was marked by the development of diagnostic methods capable of identifying the pathogens causing diseases which had long been known to humanity. Cell culture techniques, immunoassays and increasingly sensitive microscopes have become effective in diagnosing infectious diseases[35].

The evolution of knowledge related to molecular biology about the structure of nucleic acids enabled the emergence of new diagnostic methods, leading to the development of the PCR method in the 1980s, which is extremely sensitive and specific, revolutionizing the way of diagnosing infectious diseases[35]. Thus, molecular tests have improved in the last 40 years, becoming increasingly common in routine disease tracking, with the WHO recommendation on the use of RMT-TB in 2010 as an important milestone.

Of the 13 studies included in the review, six[26,28,31–34] were carried out in Brazilian prisons, probably due to the fact that the country's Ministry of Health established the municipalities that host prisons as a criterion for inclusion in the RMT-TB Network[36]. Therefore, RMT-TB has been made available free of charge by the Unified System of Health (*Sistema Único de Saúde – SUS*) in Brazil since 2014, being performed using pulmonary samples (sputum, induced sputum or bronchoalveolar

lavage) or extrapulmonary samples (cerebrospinal fluid, synovial fluid, pleural fluid, tissue macerate, lymph node puncture, peritoneal fluid and urine)[37]. Therefore, diagnosis using this technology is extremely important given that Brazil is considered one of the countries with the highest PDL in the prison system where the incidence of TB is considerably high.

Among the advantages of using RMT-TB in PDL compared to traditional and widely used methods, such as sputum smear microscopy and sputum culture, the following stand out: the possibility of identifying strains resistant to antibiotic therapy[25,27], lower financial cost when performed with a group of samples[34], reducing the time for confirmation and availability of results, corroborating early start of treatment and blocking the chain of contagion[30,33], and finally the high agreement with the reference test[28,30].

The limitation of physical space in the prison environment associated with crowding favors TB transmission, and as a result early and timely diagnosis of sick people has a direct implication in the disease spread, reducing contagion and treatment costs, with RMT-TB being an advantageous option when compared to sputum smear microscopy, as pointed out by some studies[23–27,30]. However, other studies have shown that RMT-TB had low sensitivity or had no effect on diagnosing cases in the prison system[23,28–29,31].

Due to the transmission of the disease through the airways, TB can manifest itself together with respiratory virus infections, as occurred during the COVID-19 pandemic[38], which made the prognosis of TB complex, and reinforced the importance of precocity in diagnosis, ensuring appropriate and timely treatment in co-infection situations considering TB and COVID-19.

In addition to respiratory diseases, a cross-sectional study[23] included in this review showed the effectiveness of using RMT-TB in PDL living with HIV. The authors highlighted that the test identified a high prevalence of active TB in prisoners, with the prevalence not being identified through sputum smear microscopy; this corroborates practices that encourage the use of molecular tests as a way of ensuring early diagnosis and adequate treatment[23].

The effect of using the RMT-TB goes beyond its accuracy in terms of specificity and sensitivity, reaching a subjective social aspect for individuals little assisted by health actions. Carrying out systematic monitoring of TB among PDL goes beyond both technical and biological variables, as it is related to social determinants of health[33].

Some studies have shown superior performance of RMT-TB when comparing it to sputum smear microscopy in the diagnosis of PDL cases, reinforcing the WHO recommendation regarding replacement of sputum smear tests by RMT in the diagnosis of active TB[23–27,30].

In addition to comparisons with sputum smear microscopy, a study carried out in three prisons in Brazil[32] showed that interpreting images by x-ray performed *in silico* (Screening Algorithms) by four different screening algorithms was less effective and less expensive when compared to RMT-TB. The incorporation of RMT-TB into the annual screening strategy was also shown to be more advantageous when compared to mass radiography screening performed alone in two studies[22,24], which were carried out in prisons in Russia and Azerbaijan, respectively.

However, some studies have highlighted a limitation in the sensitivity of RMT-TB, especially in large prisons where there is a need for training unit teams in order to guarantee the quality of the samples collected and the adequate processing of sputum to ensure a accurate and reliable diagnosis[23,28–29,31]. This aspect pointed out by the authors reveals failure not of the test mechanisms themselves, because (as previously presented) molecular nucleic acid amplification assays are considered the evolution of diagnoses for diseases infectious diseases, but the prerogative of managing the process is training those responsible for collecting the samples and carrying out the test itself.

Some studies[28,30,33] pointed out that RMT-TB was as effective as culture (Reference Test), resulting in a reduction in the delay in microbiological diagnosis in inmates with negative sputum smear

microscopy at the start of treatment, showing that consecutive negative results to RMT-TB accelerated suspension of the isolation period for inmates, which contributes to managing and optimizing physical spaces, especially in contexts marked by overcrowding.

Thus, as in other bacteria, the indiscriminate use of antibiotics leads to the emergence of resistant strains of *M. tuberculosis*. Such strains accumulate mutations as a way of adapting to antibiotic therapy[39]. RMT-TB is recognized worldwide for its agility in diagnosis and also works to identify strains resistant to rifampicin (an antibiotic used to treat TB)[40]. Regarding PDL, some studies[25,27,34] highlighted the applicability of RMT-TB in identifying strains resistant to rifampicin, being important to correctly implement the corresponding therapy, ensuring better care to sick people, as well as impacting the spread of antimicrobial-resistant TB in the prison environment.

Based on the results presented, it is possible to verify that the use of RMT-TB for PDL is relevant for preventing the multiplication of resistant strains. Furthermore, incorporating the use of RMT-TB in the prison system is a strategic measure for controlling the disease, and should be among the political priorities of health and public safety managers, whose consequences and benefits extend to workers and the community that lives around the prison units.

Therefore, as an important comprehensive healthcare management technology, the use of RMT-TB also moves from individual to societal dimensions, with the latter being applied to the role of the State as a promoter of social and health policies anchored in the commitment to citizenship, right to life and dignity[41].

Finally, failure to evaluate the methodological quality of the included studies and the failure to analyze the quality of the evidence in this review can be pointed out as limitations of this study.

CONCLUSION

The studies analyzed in this scoping review highlighted the positive aspects of using RMT-TB in the studied population, such as: the possibility of diagnosing more cases of TB than sputum smear microscopy, despite some studies indicating that the test had low sensitivity or had no effect in the diagnosis of cases in the prison system; its use reduces the time required for diagnosis, initiation of treatment and suspension of the isolation period; it favors identifying strains which are resistant to antibiotic therapy; reduced prevalence and consequently the occurrence of TB; high agreement of RMT-TB results with culture results; lower cost when carried out with a group of samples; and lower cost than radiography screening. These characteristics make RMT-TB an effective tool for combating TB in prison units.

Therefore, this study supports the importance of addressing TB in environments where the transmission of the disease can be facilitated, such as prison systems. Furthermore, it should be noted that implementing RMT-TB in the prison system favors diagnosing the disease more quickly, allowing earlier start of treatment and adoption of control measures to prevent the disease spreading within institutions. Testing helps to identify asymptomatic cases, which are more difficult to detect, but equally important for controlling the disease.

However, it is worth highlighting the prerogative that testing is accompanied by a comprehensive TB control program, coordinated with the justice and security sectors, which includes adequate treatment for people with the infection, health education, improvement of hygiene and ventilation conditions in prison facilities, and regular monitoring of diagnosed cases. In turn, this strategy can significantly contribute to advances in preventing the spread of TB among the PDL and also in the community in general.

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NOTES

CONTRIBUTION OF AUTHORITY

Study design: Naves EF, Andrade RLP, Monroe AA.
Data collection: Naves EF, Andrade RLP.
Data analysis and interpretation: Naves EF, Andrade RLP, Faria MGBF, Monroe AA.
Discussion of results: Naves EF, Andrade RLP, Faria MGBF, Magnabosco GT, Bonfim RO, Ferreira MRL, Bollela VR, Monroe AA.
Writing and/or critical review of content: Naves EF, Andrade RLP, Faria MGBF, Magnabosco GT, Bonfim RO, Ferreira MRL, Bollela VR, Monroe AA.
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CORRESPONDING AUTHOR

Rubia Laine de Paula Andrade.
rubia@eerp.usp.br